REMARKS

Claims 18-59 are in the application.

FORMAL REJECTIONS

Claims 18-59 are rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement.

Claims 18-59 are also rejected under 35 U.S.C. § 112, first paragraph, as allegedly not being supported by an enabling specification.

Applicants have eliminated the denominated "consistency analysis" from the claims, and have, in general, clarified the thermodynamic analysis. Applicant's prior arguments relating to the nature of thermodynamic analysis is incorporated herein by reference; to summarize, a thermodynamic analysis is a quantitative analysis of a system in accordance with the laws of thermodynamics.

ART REJECTIONS

Claims 39-45 are rejected under 35 U.S.C. § 103(a) as being obvious in view of Hebert (US 7,139,564) in view of applicant's admitted prior art.

Claims 18, 21 and 46, and their respective dependent claims, are rejected as being obvious under 35 U.S.C. § 103 over Hebert, applicants' admitted prior art, and newly cited Keeler et al., US 6,243,696.

Prior claims 18-38 and 46-59 were apparently distinguished from Hebert alone based on the language "storing parameters of a model of a refrigeration system derived from measurements of actual operational parameters of the refrigeration system". Claims 39-45 are believed to now adopt this essential distinction as well. See ***bold italic*** text in claims markup, below. In each of the present independent claims, the model is derived from actual operation parameters or the like, and thus is believed to distinguish Hebert on at least that basis.

Hebert implements a system and method where operational parameters of a HVAC/refrigeration system are compared to **nominal** values of the same **type** of system, to determine a deviation, and not compared with a model derived from its own actual performance, as set forth in each independent claim. Thus, the reference "model" of the refrigeration system,

if any, created by Hebert is a theoretical one based on nominal performance data and not one which is based on actual measurements, and does not account for installation-specific issues, aging, oil migration, scale buildup, non-condensables, and manufacturing variations. Thus, neither Hebert nor Keeler et al. can determine an installation-specific model and its subsequent use with respect to that same installation.

The present claims each provide at least two measurements of thermodynamic parameters; once to create the model, and once to compare the actual performance to the installation-specific model. See **<u>bold underline</u>** text in claims markup, below.

18. (Currently Amended) An apparatus, comprising:

a memory, storing parameters of a ***model of a refrigeration system derived from a refrigeration system configuration and measurements of actual operational parameters of the refrigeration system in a known state***;

at least one input adapted to receive operational physical parameters sufficient for performing a thermodynamic analysis of operation of the refrigeration system;

<u>a processor for estimating a difference in operating cost due to a deviance of the refrigeration system in an operating state from the refrigeration system in the known state by performing a thermodynamic analysis of the refrigeration system in the operating state based on at least the at least one input and the stored parameters in the memory</u>; and

an output for presenting the estimate of the difference in operating cost due to the deviance.

21. A method for determining a deviance from optimum of a refrigeration system, comprising:

defining a first thermodynamic model of a refrigeration system in an optimal state based on measurements of actual operating parameters of the refrigeration system;

obtaining physical parameters sufficient for performing a thermodynamic analysis of the refrigeration system at a time when the refrigeration system is not performing optimally;

automatically performing a thermodynamic analysis of the refrigeration system based on the obtained physical parameters to define a second thermodynamic model;

comparing the first thermodynamic model to the second thermodynamic model of the refrigeration system; and

<u>outputting a quantitative estimate of an operating cost of deviance of the state of the refrigeration system at the time when the refrigeration system is not performing optimally from the determined optimal state of the refrigeration system based on said comparing</u>.

39. A method, comprising the steps of:

thermodynamically modeling operation of a refrigeration system comprising a refrigerant having a refrigerant purity and a compressor operating at a compressor

power, by acquiring actual operating parameters, to generate a thermodynamic model, and determining a sensitivity of the thermodynamic model of the refrigeration system to perturbations with respect to at least the refrigerant purity and a superheat level;

measuring an actual performance of the refrigeration system;

predicting a thermodynamic effect of an alteration of the refrigerant purity and the compressor power with respect to the measured actual performance and the determined sensitivity;

altering the refrigerant purity and the compressor power to in dependence on the predicted thermodynamic effect on the refrigeration system under operating conditions.

43. A method, comprising the steps of:

performing a thermodynamic analysis of a refrigeration system based on actual operational parameters to derive a thermodynamic model of the refrigeration system;

determining an efficiency of the refrigeration system based on the thermodynamic model of the refrigeration system;

determining a cost-efficient optimum range of operation of the refrigeration system based on the determined efficiency, a cost associated with operation of the refrigeration system in a respective operating state, and a cost associated with an alteration of at least one operating physical parameter of the refrigeration system to a respective different operating state;

analyzing the thermodynamic model of the refrigeration system with respect to a set of measured thermodynamic data of the refrigeration system during operation at an operating state; and

presenting an estimate of a deviance of the operating state from the optimal range of the refrigeration system, sensitive to at least said analyzing.

46. A method for analyzing a refrigeration system, comprising measuring physical parameters sufficient for performing a thermodynamic analysis of refrigeration system operation, ***determining a model of the refrigeration system which defines a refrigeration system configuration based on a thermodynamic analysis of the measured physical parameters***; determining a sensitivity of an efficiency of the refrigeration system to changes in physical parameters based on measurements of refrigeration system performance under a plurality of different operating conditions, **estimating a deviance from the defined system configuration of the refrigeration system, by performing an analysis of the model of the refrigeration system and measured operating parameters of the refrigeration system**, and outputting the estimate of the deviance.

The specification teaches that for each installation, the physical configuration (e.g., non-condensables, oil migration, etc.) may change over time, and therefore that a theoretical model may not accurately describe a particular refrigeration system which has been in operation for a period, and indeed, depending on the installation, may never have accurately described that installation. Thus, attempts to optimize a refrigeration system based on such a theoretical model may lead to inconsistencies or reductions in efficiency instead of the hoped-for improvements.

Worse yet, such a scheme does not provide the tools appropriate to determine when such a contradictory result is achieved.

The claims also include further distinctions which render them patentably distinct.

For example, claim 18 provides "a processor for estimating a difference in operating cost due to a deviance of the refrigeration system in an operating state from the refrigeration system in the known state by performing a thermodynamic analysis of the refrigeration system in the operating state based on at least the at least one input and the stored parameters in the memory."

Claim 21 provides for "outputting a quantitative estimate of an operating cost of deviance of the state of the refrigeration system at the time when the refrigeration system is not performing optimally from the determined optimal state of the refrigeration system based on said comparing."

Claim 39 provides for "determining a sensitivity of the thermodynamic model of the refrigeration system to perturbations with respect to at least the refrigerant purity and a superheat level" and "predicting a thermodynamic effect of an alteration of the refrigerant purity and the compressor power with respect to the measured actual performance and the determined sensitivity".

Claim 43 provides for "determining a cost-efficient optimum range of operation of the refrigeration system based on the determined efficiency, a cost associated with operation of the refrigeration system in a respective operating state, and a cost associated with an alteration of at least one operating physical parameter of the refrigeration system to a respective different operating state" and "presenting an estimate of a deviance of the operating state from the optimal range of the refrigeration system, sensitive to at least said analyzing."

Claim 46 provides for "determining a sensitivity of an efficiency of the refrigeration system to changes in physical parameters based on measurements of refrigeration system performance under a plurality of different operating conditions."

Thus, it is respectfully submitted that the claims distinguish the art, and provide materially different systems and methods from Hebert and Keeler, and which achieve different results.

Reconsideration of the rejections of the claims as being obvious in view of the art is respectfully solicited.

If the examiner believes it would be helpful to resolve the outstanding issues, applicants' undersigned attorney invites a telephone conference wherein material resolution or simplification of the issues might be possible.

Respectfully submitted,

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